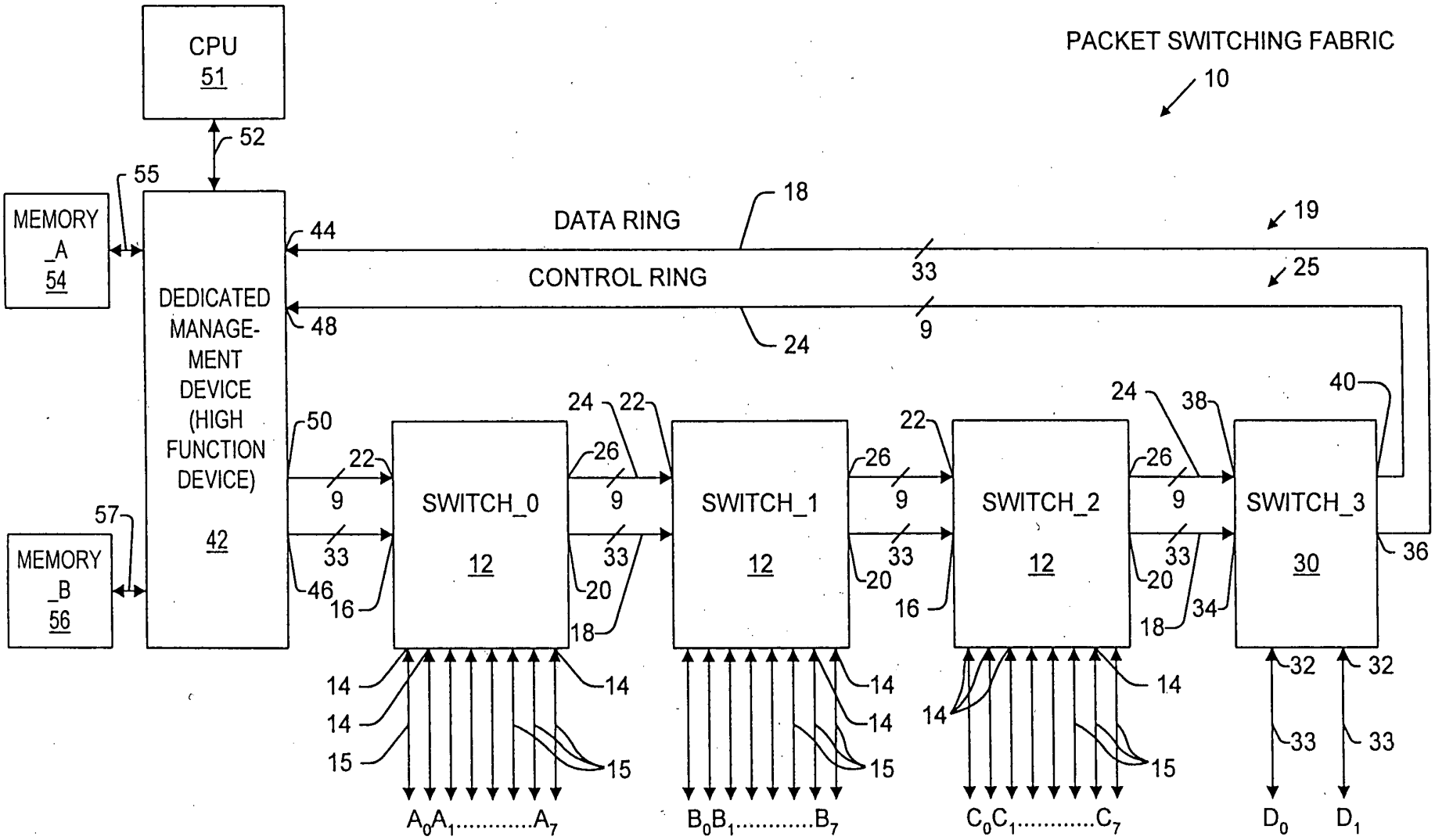

CPU
51
52
55
MEMORY
_A
54
DEDICATED
MANAGE-
MENT
DEVICE
(HIGH
FUNCTION
DEVICE)
42
57
MEMORY
_B
56
PACKET SWITCHING FABRIC
10
DATA RING
18
19
CONTROL RING
25
44
48
33
9
24
50
46
16
22
9
33
SWITCH_0
12
SWITCH_1
12
SWITCH_2
12
SWITCH_3
30
20
18
26
38
40
36
34
32
14
15
A_0A_1.....A_7
B_0B_1.....B_7
C_0C_1.....C_7
D_0
D_1

FIG. 1

FIG.2A

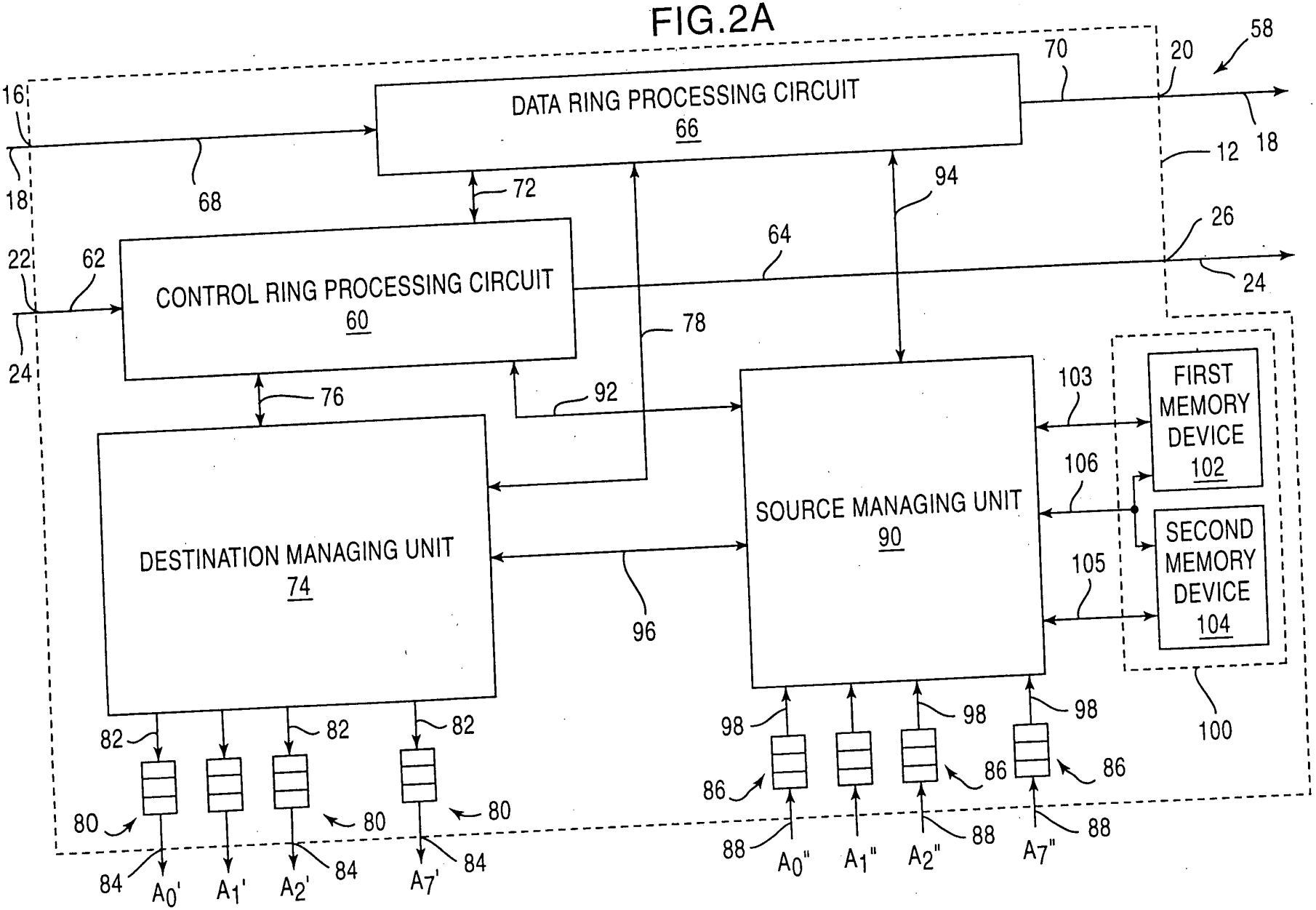
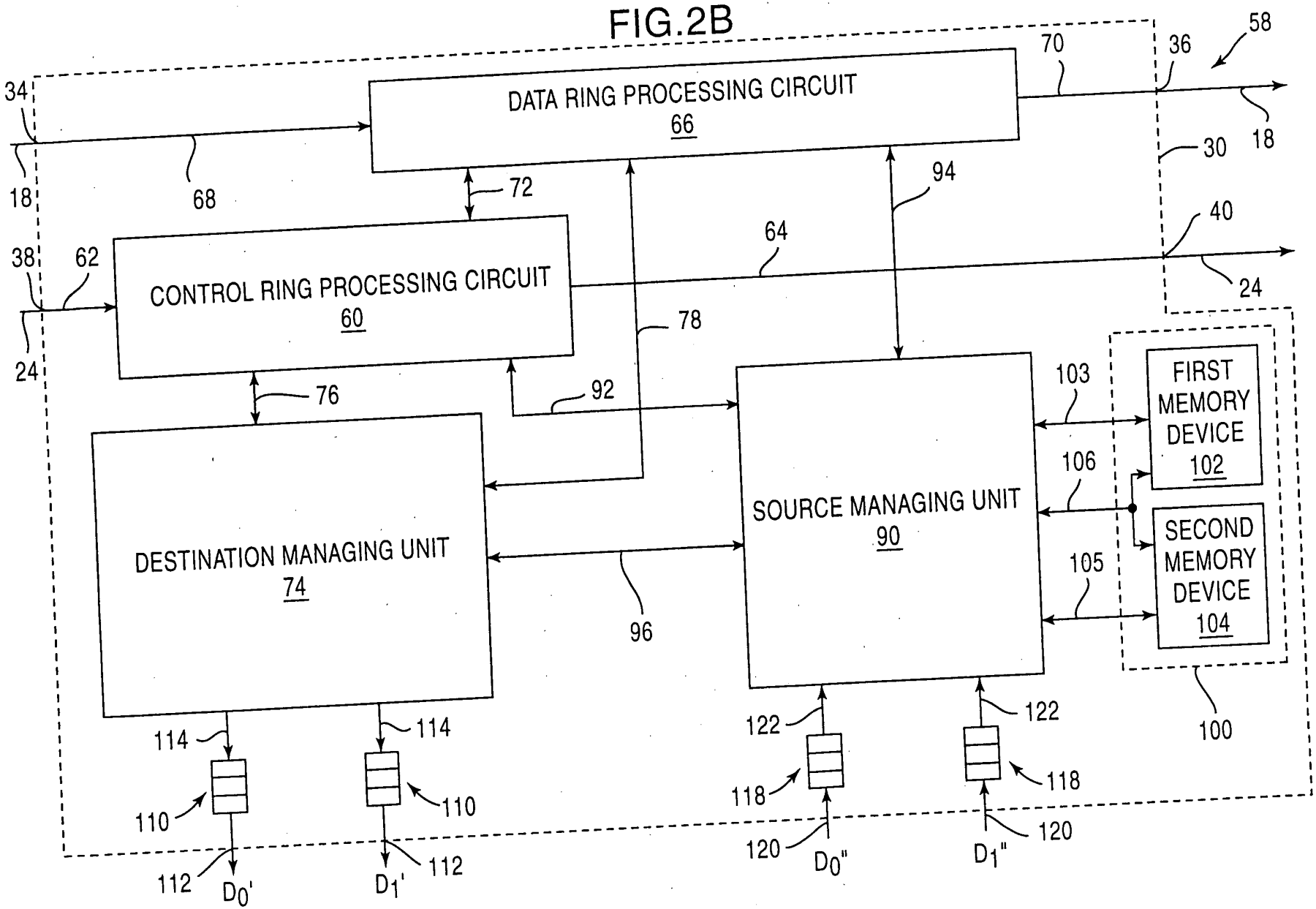

DATA RING PROCESSING CIRCUIT
66
CONTROL RING PROCESSING CIRCUIT
60
DESTINATION MANAGING UNIT
74
SOURCE MANAGING UNIT
90
FIRST MEMORY DEVICE
102
SECOND MEMORY DEVICE
104
16
18
68
70
20
58
18
12
72
94
64
26
22
62
24
24
78
76
92
103
106
105
96
100
82
82
82
98
98
98
80
80
80
86
86
86
84
84
84
88
88
88
A0'
A1'
A2'
A7'
A0"
A1"
A2"
A7"

FIG.2B


DATA RING PROCESSING CIRCUIT
66
CONTROL RING PROCESSING CIRCUIT
60
DESTINATION MANAGING UNIT
74
SOURCE MANAGING UNIT
90
FIRST MEMORY DEVICE
102
SECOND MEMORY DEVICE
104
34
18
68
70
36
58
18
30
72
94
40
64
38
62
24
24
78
76
92
103
106
105
96
100
114
114
122
122
110
110
118
118
112
112
120
120
D0'
D1'
D0"
D1"

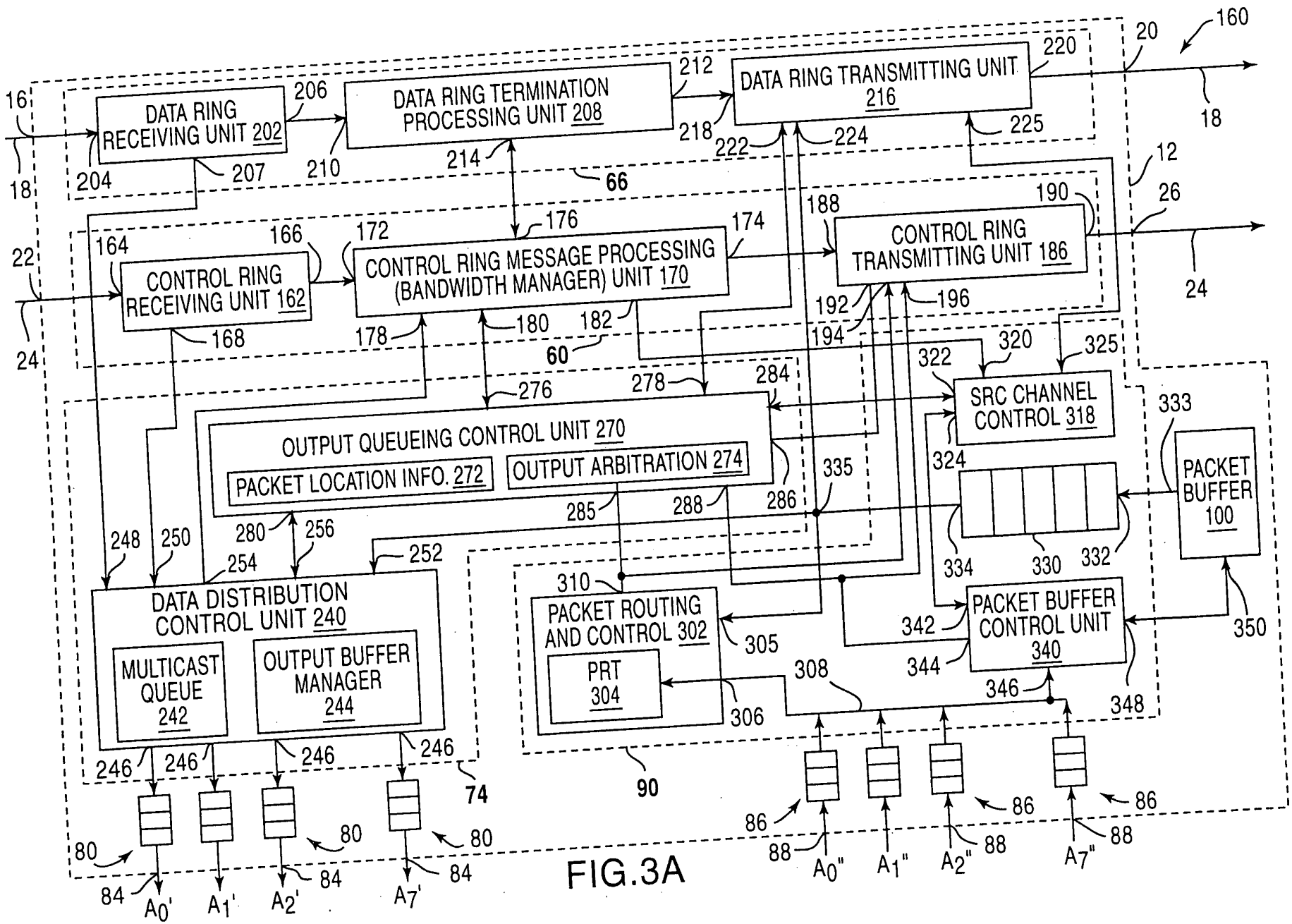

DATA RING RECEIVING UNIT 202
DATA RING TERMINATION PROCESSING UNIT 208
DATA RING TRANSMITTING UNIT 216
CONTROL RING RECEIVING UNIT 162
CONTROL RING MESSAGE PROCESSING (BANDWIDTH MANAGER) UNIT 170
CONTROL RING TRANSMITTING UNIT 186
OUTPUT QUEUEING CONTROL UNIT 270
PACKET LOCATION INFO. 272
OUTPUT ARBITRATION 274
SRC CHANNEL CONTROL 318
PACKET BUFFER 100
DATA DISTRIBUTION CONTROL UNIT 240
MULTICAST QUEUE 242
OUTPUT BUFFER MANAGER 244
PACKET ROUTING AND CONTROL 302
PRT 304
PACKET BUFFER CONTROL UNIT 340
16
18
20
22
24
26
60
66
74
90
160
A0'
A1'
A2'
A7'
A0"
A1"
A2"
A7"

FIG.3A

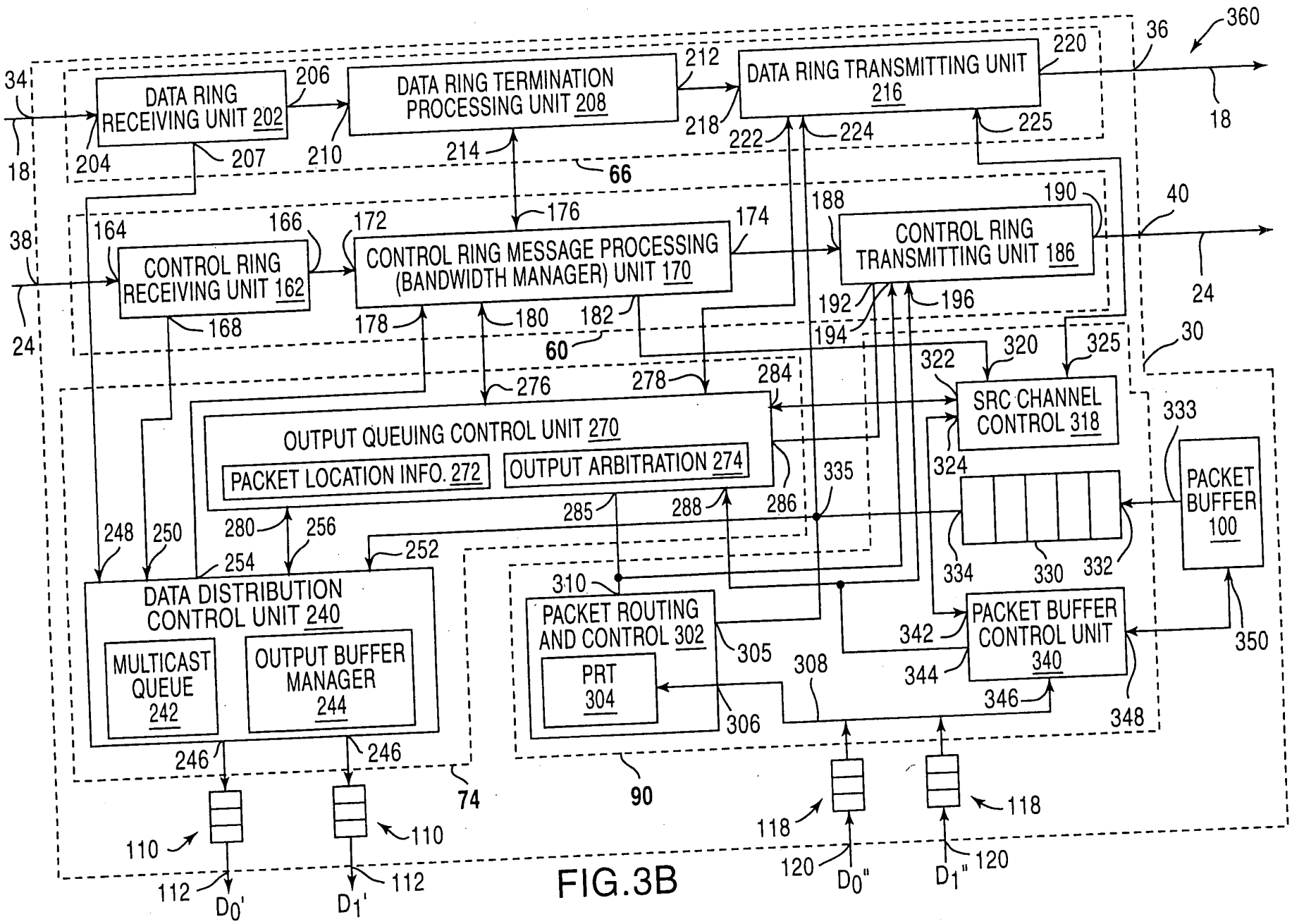

DATA RING RECEIVING UNIT 202
DATA RING TERMINATION PROCESSING UNIT 208
DATA RING TRANSMITTING UNIT 216
CONTROL RING RECEIVING UNIT 162
CONTROL RING MESSAGE PROCESSING (BANDWIDTH MANAGER) UNIT 170
CONTROL RING TRANSMITTING UNIT 186
OUTPUT QUEUING CONTROL UNIT 270
PACKET LOCATION INFO. 272
OUTPUT ARBITRATION 274
SRC CHANNEL CONTROL 318
PACKET BUFFER 100
DATA DISTRIBUTION CONTROL UNIT 240
MULTICAST QUEUE 242
OUTPUT BUFFER MANAGER 244
PACKET ROUTING AND CONTROL 302
PRT 304
PACKET BUFFER CONTROL UNIT 340
34
18
204
206
207
210
212
214
66
218
220
222
224
225
36
360
38
24
164
166
168
172
174
176
178
180
182
60
188
190
192
194
196
40
30
320
322
325
276
278
284
333
324
335
285
288
286
248
250
280
256
252
254
310
305
308
342
344
346
348
350
334
330
332
246
74
90
110
112
118
120
D0'
D1'
D0"
D1"

FIG.3B

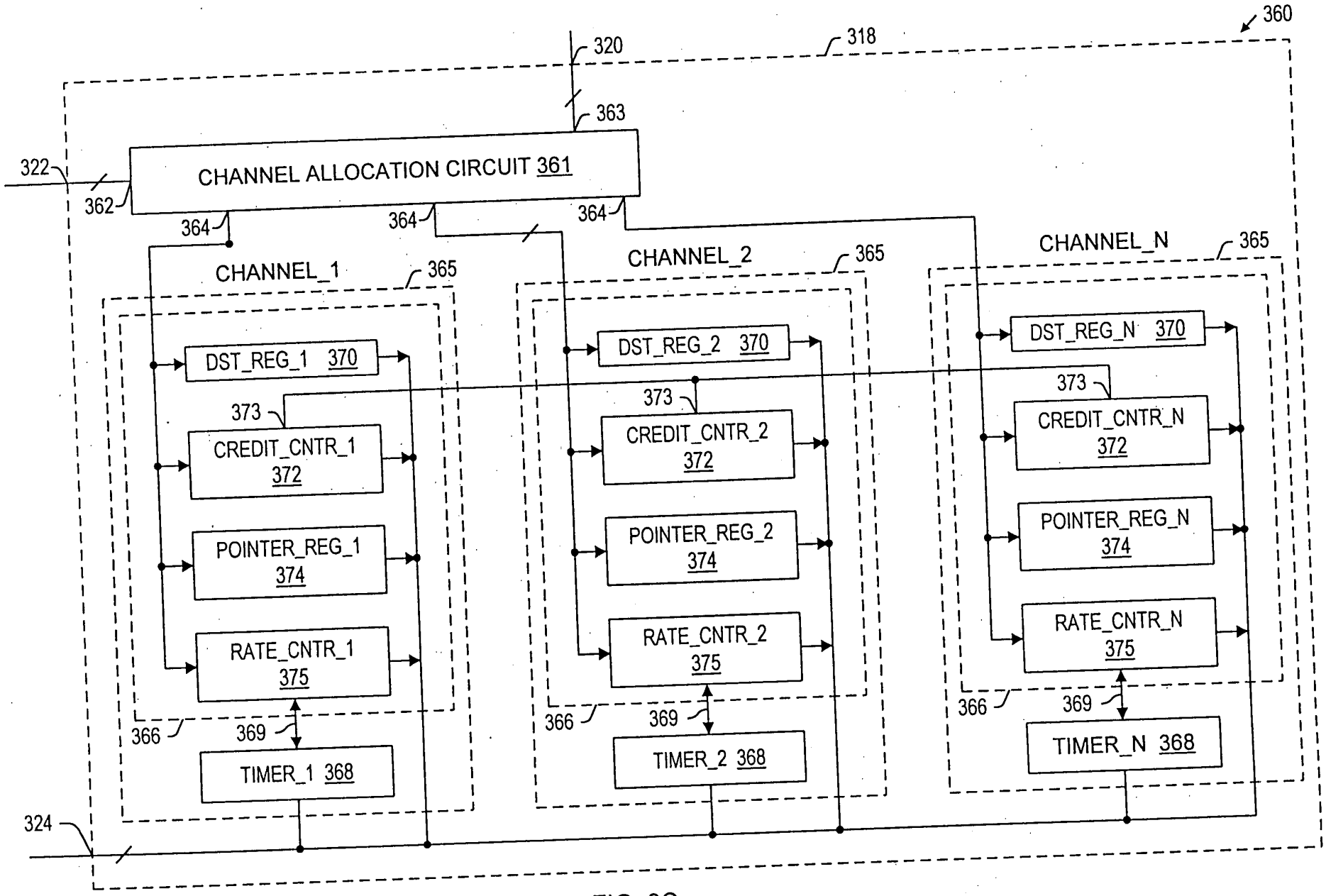

360
320
318
363
322
CHANNEL ALLOCATION CIRCUIT 361
362
364
364
364
CHANNEL_1
365
CHANNEL_2
365
CHANNEL_N
365
DST_REG_1 370
DST_REG_2 370
DST_REG_N 370
373
373
373
CREDIT_CNTR_1 372
CREDIT_CNTR_2 372
CREDIT_CNTR_N 372
POINTER_REG_1 374
POINTER_REG_2 374
POINTER_REG_N 374
RATE_CNTR_1 375
RATE_CNTR_2 375
RATE_CNTR_N 375
366
369
366
369
366
369
TIMER_1 368
TIMER_2 368
TIMER_N 368
324

FIG. 3C

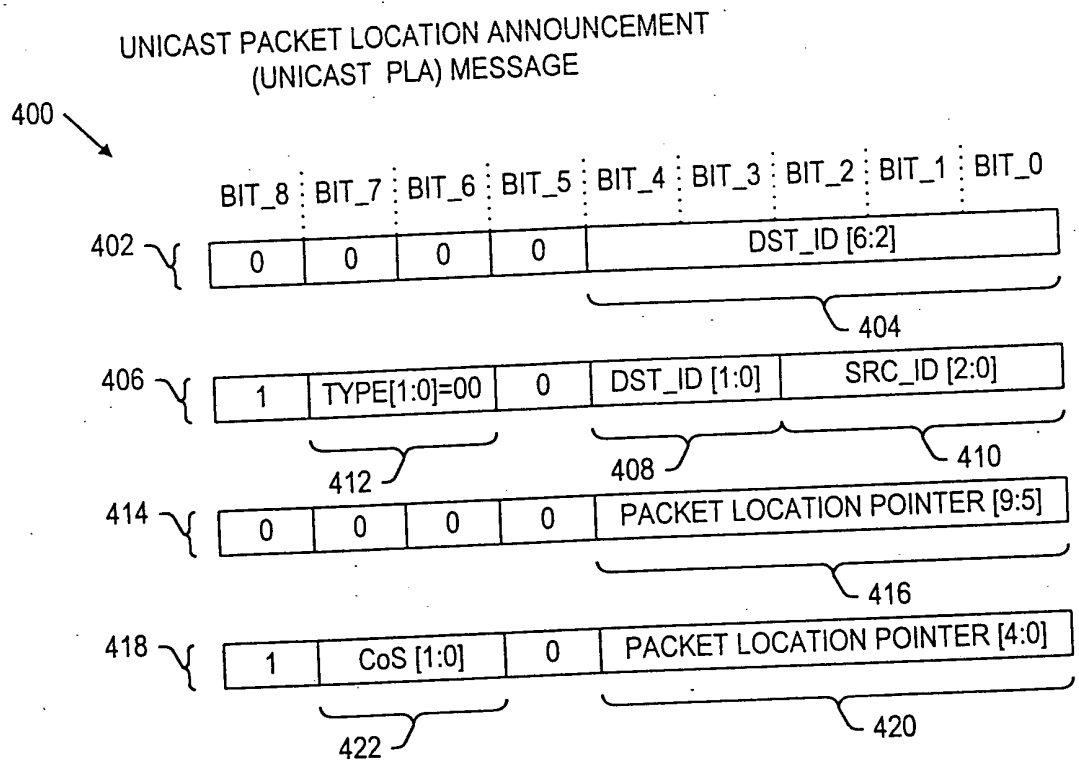

UNICAST PACKET LOCATION ANNOUNCEMENT
(UNICAST PLA) MESSAGE
400
BIT_8
BIT_7
BIT_6
BIT_5
BIT_4
BIT_3
BIT_2
BIT_1
BIT_0
402
0
0
0
0
DST_ID [6:2]
404
406
1
TYPE[1:0]=00
0
DST_ID [1:0]
SRC_ID [2:0]
412
408
410
414
0
0
0
0
PACKET LOCATION POINTER [9:5]
416
418
1
CoS [1:0]
0
PACKET LOCATION POINTER [4:0]
422
420

FIG. 4A

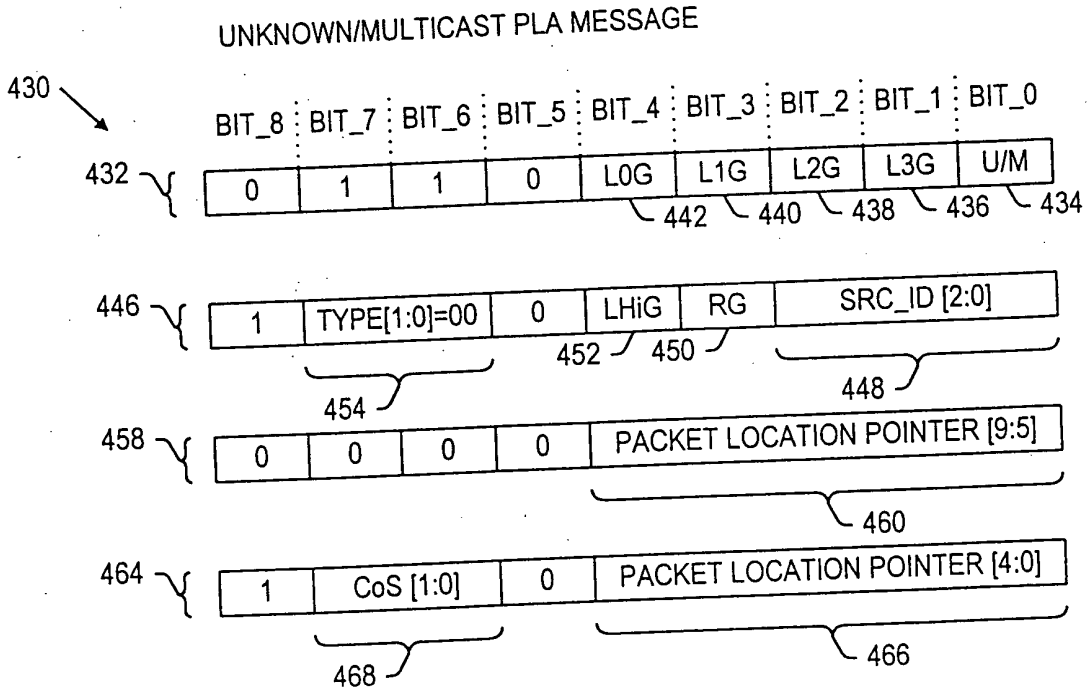

UNKNOWN/MULTICAST PLA MESSAGE
430
BIT_8
BIT_7
BIT_6
BIT_5
BIT_4
BIT_3
BIT_2
BIT_1
BIT_0
432
0
1
1
0
L0G
L1G
L2G
L3G
U/M
442
440
438
436
434
446
1
TYPE[1:0]=00
0
LHiG
RG
SRC_ID [2:0]
452
450
454
448
458
0
0
0
0
PACKET LOCATION POINTER [9:5]
460
464
1
CoS [1:0]
0
PACKET LOCATION POINTER [4:0]
468
466

FIG. 4B

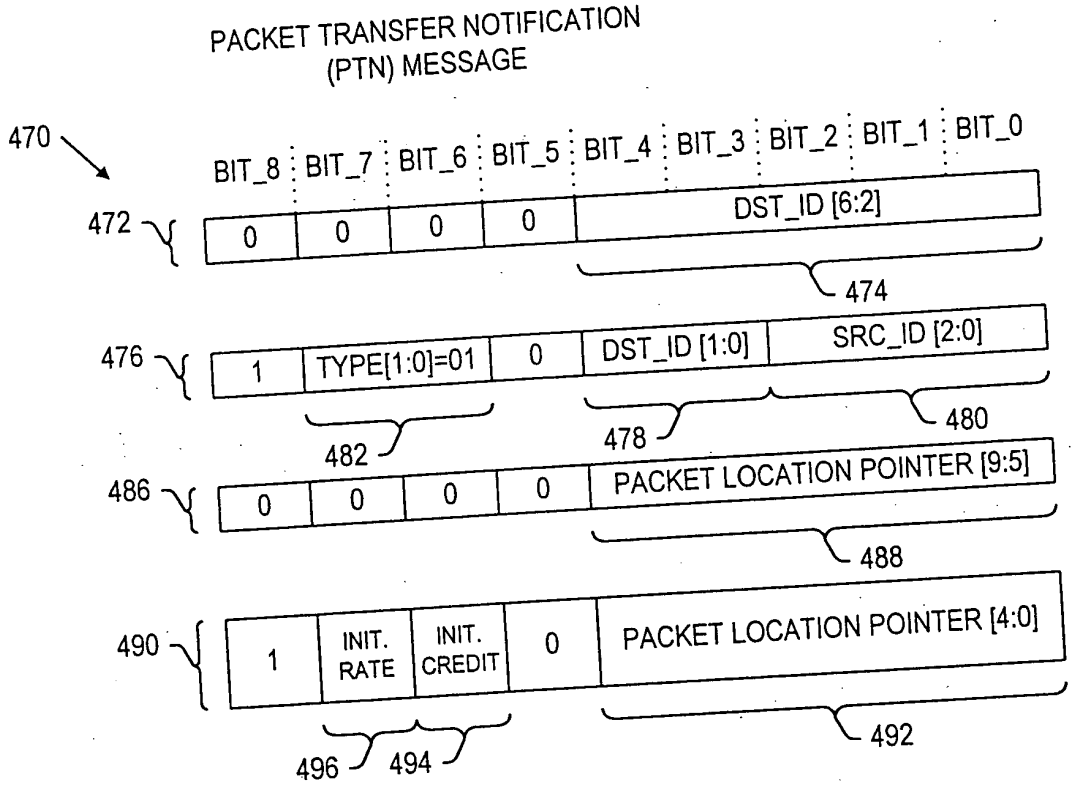

PACKET TRANSFER NOTIFICATION
(PTN) MESSAGE
470
BIT_8
BIT_7
BIT_6
BIT_5
BIT_4
BIT_3
BIT_2
BIT_1
BIT_0
472
0
0
0
0
DST_ID [6:2]
474
476
1
TYPE[1:0]=01
0
DST_ID [1:0]
SRC_ID [2:0]
482
478
480
486
0
0
0
0
PACKET LOCATION POINTER [9:5]
488
490
1
INIT. RATE
INIT. CREDIT
0
PACKET LOCATION POINTER [4:0]
496
494
492

FIG. 4C

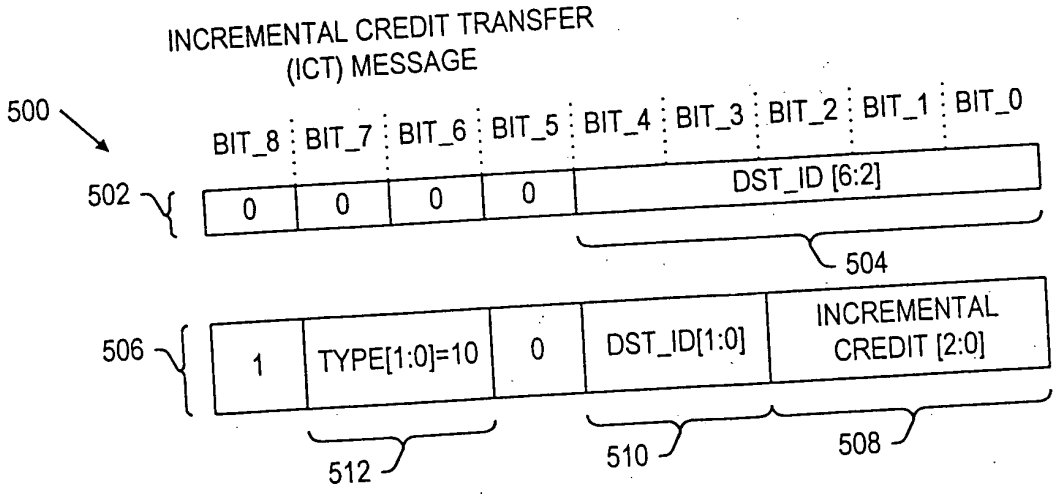

INCREMENTAL CREDIT TRANSFER
(ICT) MESSAGE
500
BIT_8
BIT_7
BIT_6
BIT_5
BIT_4
BIT_3
BIT_2
BIT_1
BIT_0
502
0
0
0
0
DST_ID [6:2]
504
506
1
TYPE[1:0]=10
0
DST_ID[1:0]
INCREMENTAL CREDIT [2:0]
512
510
508

FIG. 4D

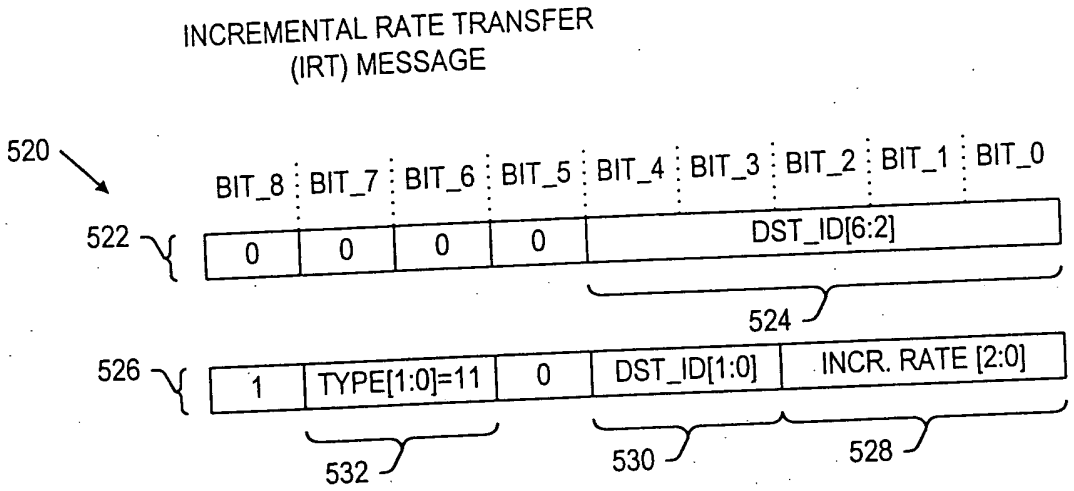

INCREMENTAL RATE TRANSFER
(IRT) MESSAGE
520
BIT_8
BIT_7
BIT_6
BIT_5
BIT_4
BIT_3
BIT_2
BIT_1
BIT_0
522
0
0
0
0
DST_ID[6:2]
524
526
1
TYPE[1:0]=11
0
DST_ID[1:0]
INCR. RATE [2:0]
532
530
528

FIG. 4E

SOURCE IDENTIFICATION MAPPING TABLE

540

	SRC_ID[7:0]	SOURCE
542	0000_0000~0000_0111	LOCAL SWITCH DEVICE 0, PORT 0 ~ PORT 7
	0000_1000~0000_1111	LOCAL SWITCH DEVICE 0, RESERVED
544	0001_0000~0001_0111	LOCAL SWITCH DEVICE 1, PORT 0 ~ PORT 7
	0001_1000~0001_1111	LOCAL SWITCH DEVICE 1, RESERVED
546	0010_0000~0010_0111	LOCAL SWITCH DEVICE 2, PORT 0 ~ PORT 7
	0010_1000~0010_1111	LOCAL SWITCH DEVICE 2, RESERVED
548	0011_0000~0011_0111	LOCAL SWITCH DEVICE 3, PORT 0 ~ PORT 7
	0011_1000~0011_1111	LOCAL SWITCH DEVICE 3, RESERVED
552	0100_0000~0100_0111	LOCAL Hi-FUNCTION DEVICE 1, SOCKET 0 ~ 7
554	0100_1000~0100_1111	REMOTE Hi-FUNCTION DEVICE 1, SOCKET 0 ~ 7
556	0101_0000~0101_1111	GATEWAY 0 ~ 15
558	0110_0000~0111_1111	TRUNK 0 ~ 31
560	1000_0000~1111_1111	MULTICAST GROUP 0 ~ 127

FIG. 5A

DESTINATION IDENTIFICATION MAPPING TABLE 570

DST_ID[7:0]	SOURCE
000_0000~000_0111	LOCAL SWITCH DEVICE 0, PORT 0 ~ PORT 7
000_1000~000_1101	RESERVED
000_1110	LOCAL SWITCH DEVICE 0, 10 Mbps PORT GROUP
000_1111	LOCAL SWITCH DEVICE 0, 100 Mbps PORT GROUP
001_0000~001_0111	LOCAL SWITCH DEVICE 1, PORT 0 ~ PORT 7
001_1000~001_1101	RESERVED
001_1110	LOCAL SWITCH DEVICE 1, 10 Mbps PORT GROUP
001_1111	LOCAL SWITCH DEVICE 1, 100 Mbps PORT GROUP
010_0000~010_0111	LOCAL SWITCH DEVICE 2, PORT 0 ~ PORT 7
010_1000~010_1101	RESERVED
010_1110	LOCAL SWITCH DEVICE 2, 10 Mbps PORT GROUP
010_1111	LOCAL SWITCH DEVICE 2, 100 Mbps PORT GROUP
011_0000~011_0111	LOCAL SWITCH DEVICE 3, PORT 0 ~ PORT 7
011_1000~011_1101	RESERVED
011_1110	LOCAL SWITCH DEVICE 3, 10 Mbps PORT GROUP
011_1111	LOCAL SWITCH DEVICE 3, 100 Mbps PORT GROUP
100_0000~100_0111	LOCAL Hi-FUNCTION DEVICE 1, SOCKET 0 ~ 7
100_1000~100_1111	REMOTE Hi-FUNCTION DEVICE 1, SOCKET 0 ~ 7
101_0000~101_1111	GATEWAY 0 ~ 15
110_0000~111_1111	RESERVED

572
574
576
578
580
582
584
586

FIG. 5B

FIG.6

600

602

CHANNEL RESOURCE PATROL MESSAGE (OR TOKEN)

BIT LOCATION	DESCRIPTION
Header Bit	0
Bit 31 ~ Bit 28	0000
604 Bit 27 ~ Bit 25	SubType [2:0] = 000 (Channel Resource Patrol)
Bit 24 ~ Bit 23	Reserved
Bit 22	0
Bit 21	Reserved
Bit 20	0
606 Bit 19 ~ Bit 15	HiFunction Device LinkBW [4:0]
608 Bit 14 ~ Bit 11	HiFunction Device BBW [3:0]
610 Bit 10 ~ Bit 7	HiFunction Device ABW [3:0]
Bit 6 ~ Bit 2	00010
Bit 1 ~ Bit 0	Reserved

620

BIT LOCATION	DESCRIPTION
Header Bit	1
Bit 31 ~ Bit 29	Reserved
622 Bit 28 ~ Bit 24	Device 3 LinkBW [4:0]
Bit 23 ~ Bit 21	Reserved
624 Bit 20 ~ Bit 16	Device 2 LinkBW [4:0]
Bit 15 ~ Bit 13	Reserved
626 Bit 12 ~ Bit 8	Device 1 LinkBW [4:0]
Bit 7 ~ Bit 5	Reserved
628 Bit 4 ~ Bit 0	Device 0 LinkBW [4:0]

630

BIT LOCATION	DESCRIPTION
Header Bit	1
632 Bit 31 ~ Bit 28	Device 3 MemBBW [3:0]
634 Bit 27 ~ Bit 24	Device 3 MemABW [3:0]
636 Bit 23 ~ Bit 20	Device 2 MemBBW [3:0]
638 Bit 19 ~ Bit 16	Device 2 MemABW [3:0]
640 Bit 15 ~ Bit 12	Device 1 MemBBW [3:0]
642 Bit 11 ~ Bit 8	Device 1 MemABW [3:0]
644 Bit 7 ~ Bit 4	Device 0 MemBBW [3:0]
646 Bit 3 ~ Bit 0	Device 0 MemABW [3:0]

PACKET INITIALIZATION MESSAGE

650

652

BIT LOCATION	DESCRIPTION
Header Bit	0
Bit 31 ~ Bit 28	0000
Bit 27 ~ Bit 25	SubType [2:0] = 001 (Packet Transfer Initialization)
Bit 24 ~ Bit 23	SRC DevID [2:1]
Bit 22	0
Bit 21	SRC DevID [0]
Bit 20	0
Bit 19 ~ Bit 14	Reserved
Bit 13 ~ Bit 7	Packet DST ID [6:0]
Bit 6 ~ Bit 2	00001
Bit 1 ~ Bit 0	OPERATION TYPE 00: ABORT 01: Transmit 10: RESERVED 11: RESERVED

654 656 658 660 662

670

BIT LOCATION	DESCRIPTION
Header Bit	1
Bit 31 ~ Bit 24	Reserved
Bit 23 ~ Bit 22	Reserved
Bit 21 ~ Bit 20	Reserved
Bit 19 ~ Bit 18	Output Control For Remote HiFunction Socket 0
Bit 17 ~ Bit 16	Output Control For Gateway 7
Bit 15 ~ Bit 14	Output Control For Port 7/Gateway 6
Bit 13 ~ Bit 12	Output Control For Port 6/Gateway 5
Bit 11 ~ Bit 10	Output Control For Port 5/Gateway 4
Bit 9 ~ Bit 8	Output Control For Port 4/Gateway 3
Bit 7 ~ Bit 6	Output Control For Port 3/Gateway 2
Bit 5 ~ Bit 4	Output Control For Port 2/Gateway 1
Bit 3 ~ Bit 2	Output Control For Port 1/Gateway 0
Bit 1 ~ Bit 0	Output Control For Port 0/Local HiFunction Socket 0 00: No Transmit; 01: Transmit Without Modification; 10: Transmit With Tag; 11: Transmit Without Tag.

FIG. 7

SOURCE DEVICE MANAGING BEHAVIOR IN RESPONSE TO RECEIVING A DATA PACKET VIA A NETWORK INPUT PORT

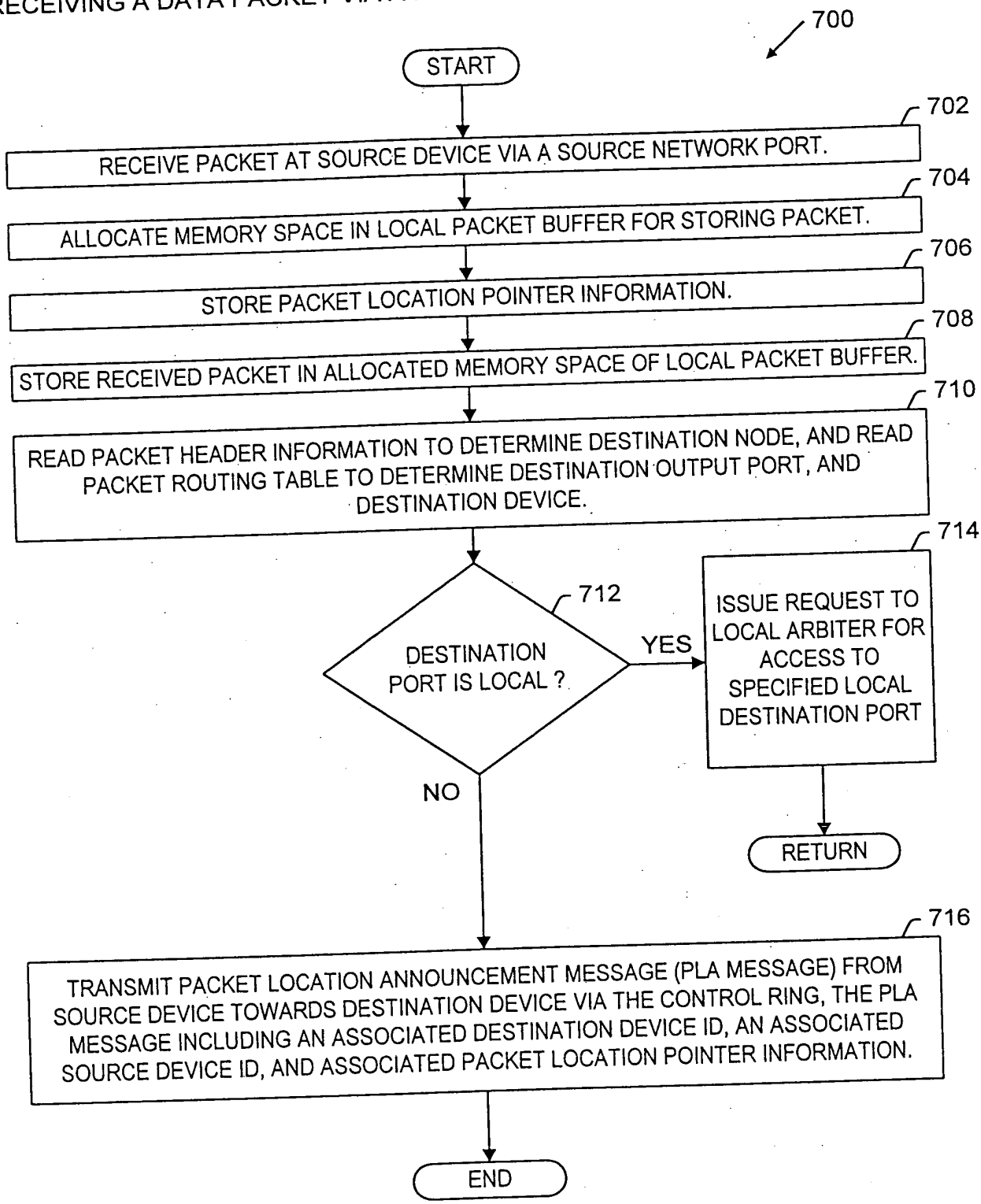


FIG. 8

DESTINATION DEVICE MANAGING BEHAVIOR IN RESPONSE TO RECEIVING A KNOWN UNICAST PACKET LOCATION ANNOUNCEMENT (PLA) MESSAGE FROM A SOURCE DEVICE

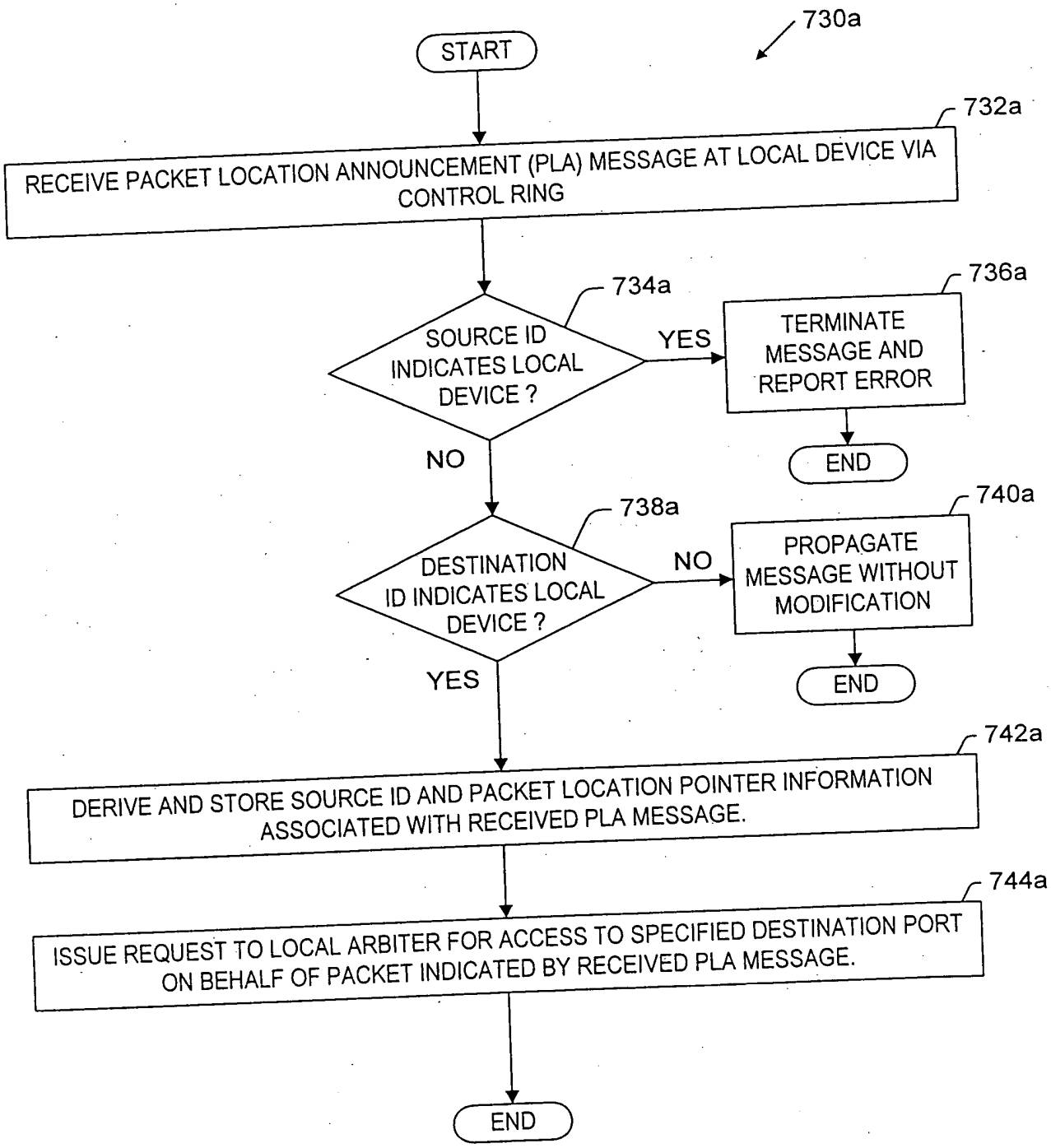


FIG. 9A

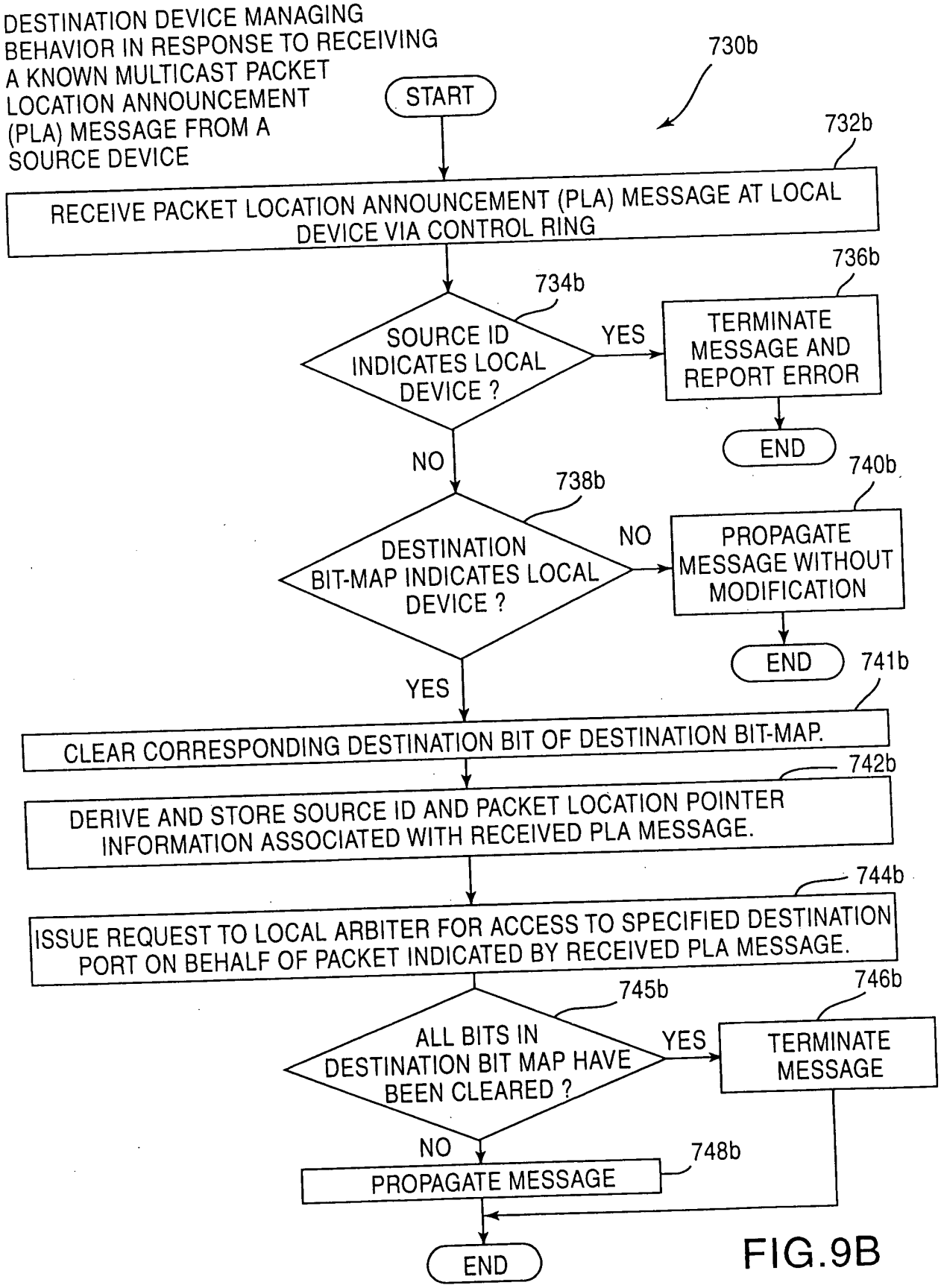

DESTINATION DEVICE MANAGING BEHAVIOR IN RESPONSE TO RECEIVING A KNOWN MULTICAST PACKET LOCATION ANNOUNCEMENT (PLA) MESSAGE FROM A SOURCE DEVICE
730b
START
732b
RECEIVE PACKET LOCATION ANNOUNCEMENT (PLA) MESSAGE AT LOCAL DEVICE VIA CONTROL RING
734b
SOURCE ID INDICATES LOCAL DEVICE ?
YES
736b
TERMINATE MESSAGE AND REPORT ERROR
END
NO
738b
DESTINATION BIT-MAP INDICATES LOCAL DEVICE ?
NO
740b
PROPAGATE MESSAGE WITHOUT MODIFICATION
END
YES
741b
CLEAR CORRESPONDING DESTINATION BIT OF DESTINATION BIT-MAP.
742b
DERIVE AND STORE SOURCE ID AND PACKET LOCATION POINTER INFORMATION ASSOCIATED WITH RECEIVED PLA MESSAGE.
744b
ISSUE REQUEST TO LOCAL ARBITER FOR ACCESS TO SPECIFIED DESTINATION PORT ON BEHALF OF PACKET INDICATED BY RECEIVED PLA MESSAGE.
745b
ALL BITS IN DESTINATION BIT MAP HAVE BEEN CLEARED ?
YES
746b
TERMINATE MESSAGE
NO
748b
PROPAGATE MESSAGE
END

FIG.9B

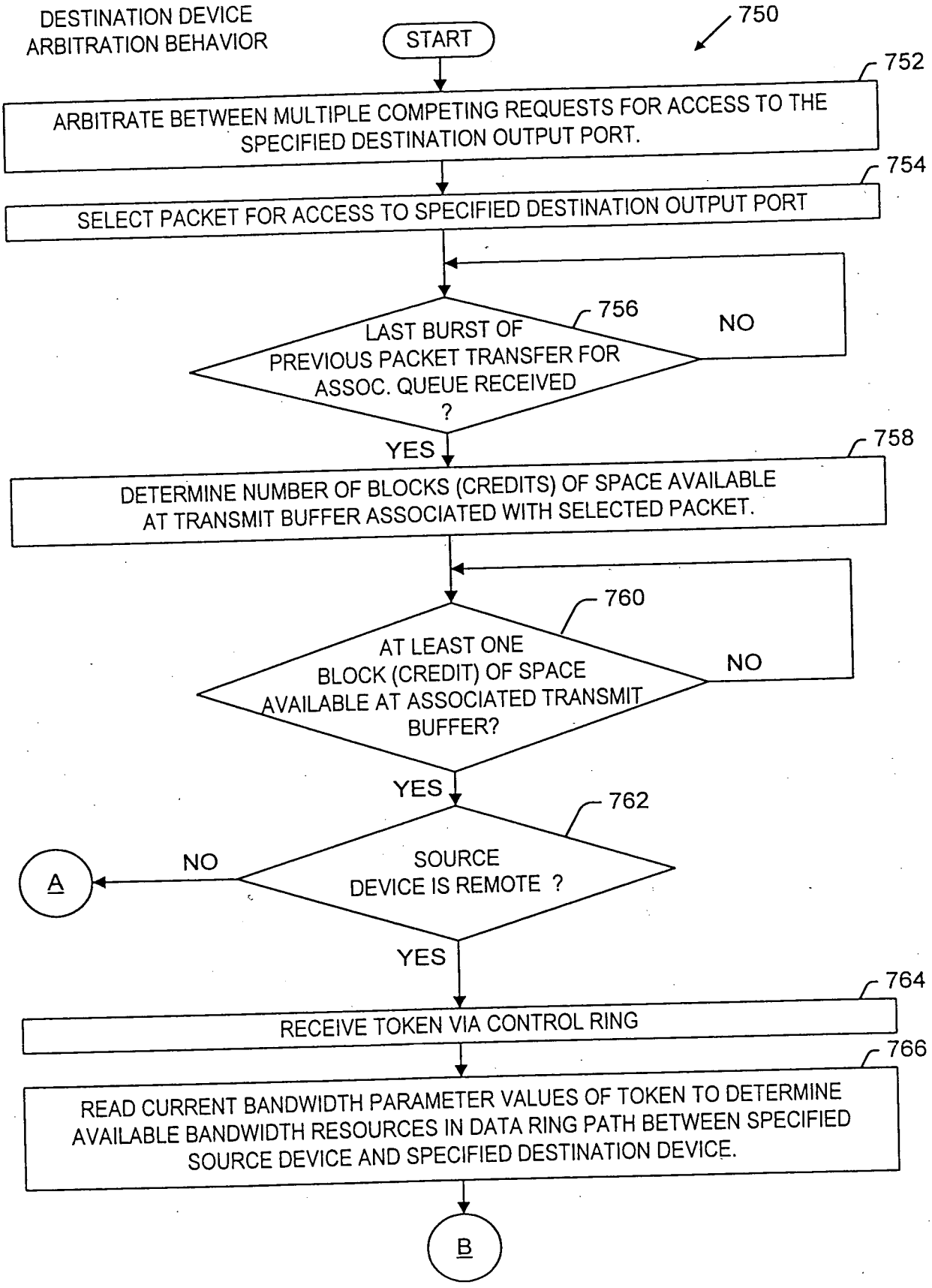

DESTINATION DEVICE ARBITRATION BEHAVIOR
START
750
752
ARBITRATE BETWEEN MULTIPLE COMPETING REQUESTS FOR ACCESS TO THE SPECIFIED DESTINATION OUTPUT PORT.
754
SELECT PACKET FOR ACCESS TO SPECIFIED DESTINATION OUTPUT PORT
756
LAST BURST OF PREVIOUS PACKET TRANSFER FOR ASSOC. QUEUE RECEIVED ?
NO
YES
758
DETERMINE NUMBER OF BLOCKS (CREDITS) OF SPACE AVAILABLE AT TRANSMIT BUFFER ASSOCIATED WITH SELECTED PACKET.
760
AT LEAST ONE BLOCK (CREDIT) OF SPACE AVAILABLE AT ASSOCIATED TRANSMIT BUFFER?
NO
YES
762
SOURCE DEVICE IS REMOTE ?
NO
A
YES
764
RECEIVE TOKEN VIA CONTROL RING
766
READ CURRENT BANDWIDTH PARAMETER VALUES OF TOKEN TO DETERMINE AVAILABLE BANDWIDTH RESOURCES IN DATA RING PATH BETWEEN SPECIFIED SOURCE DEVICE AND SPECIFIED DESTINATION DEVICE.
B

FIG. 10A

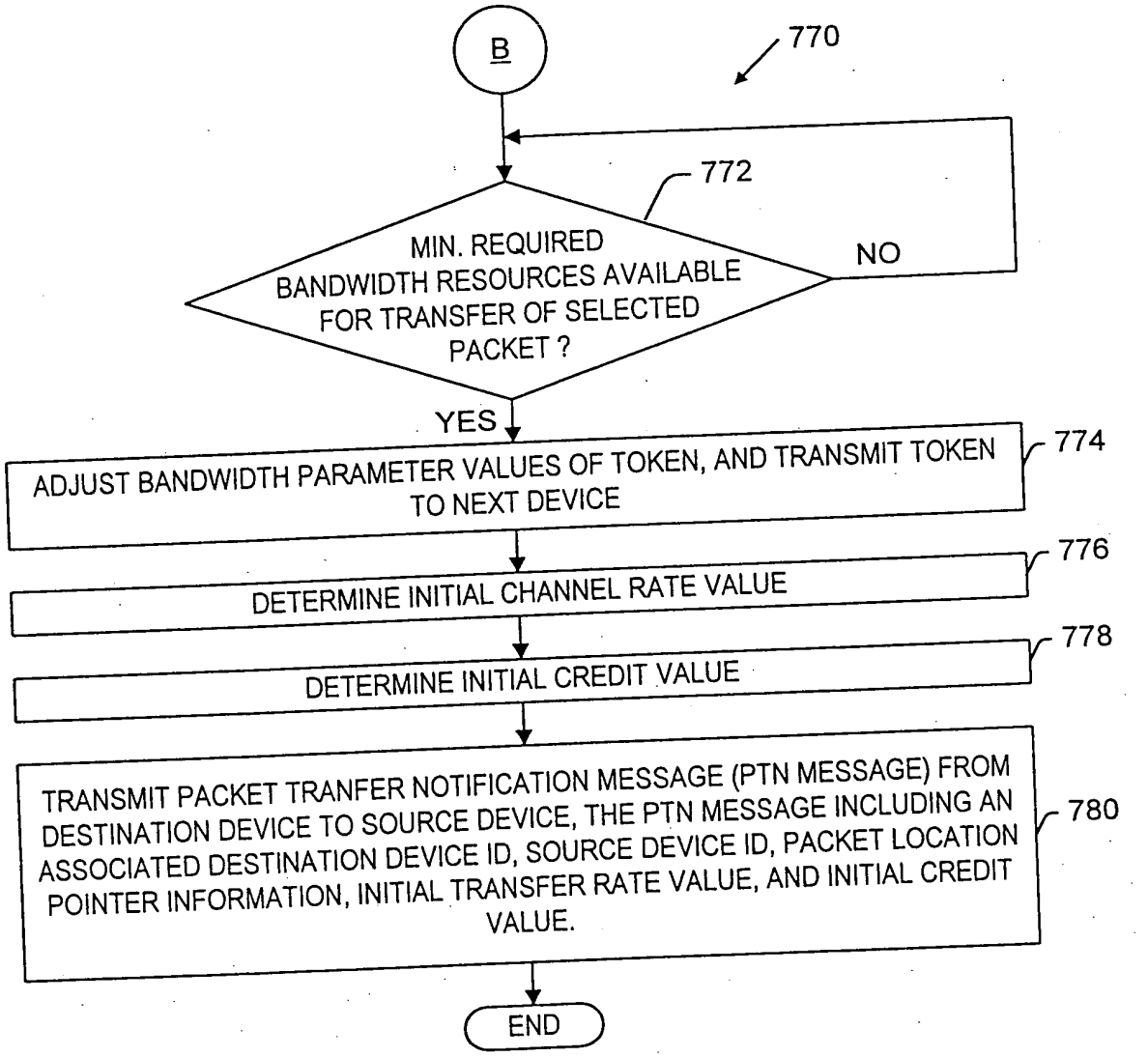


FIG. 10B

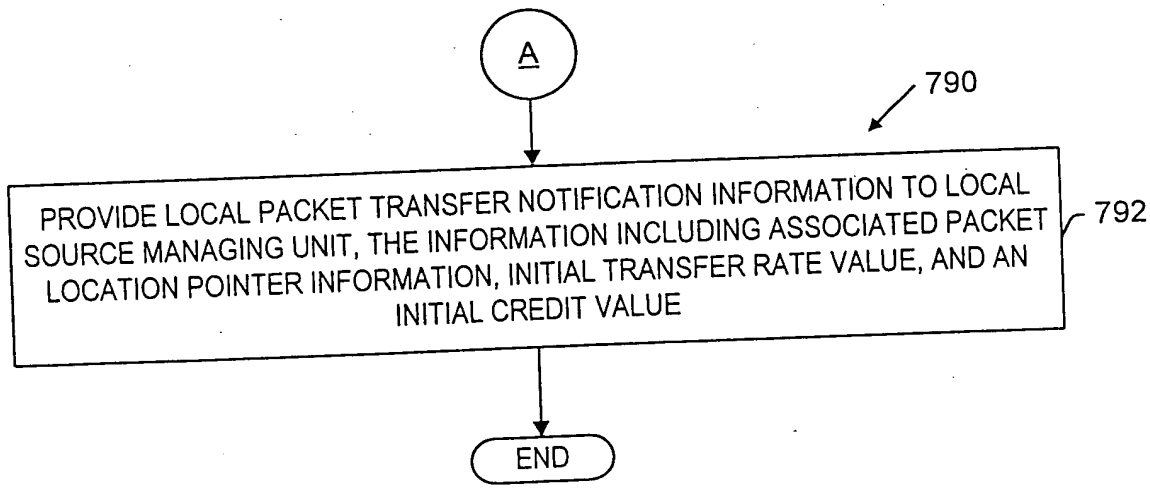


FIG. 10C

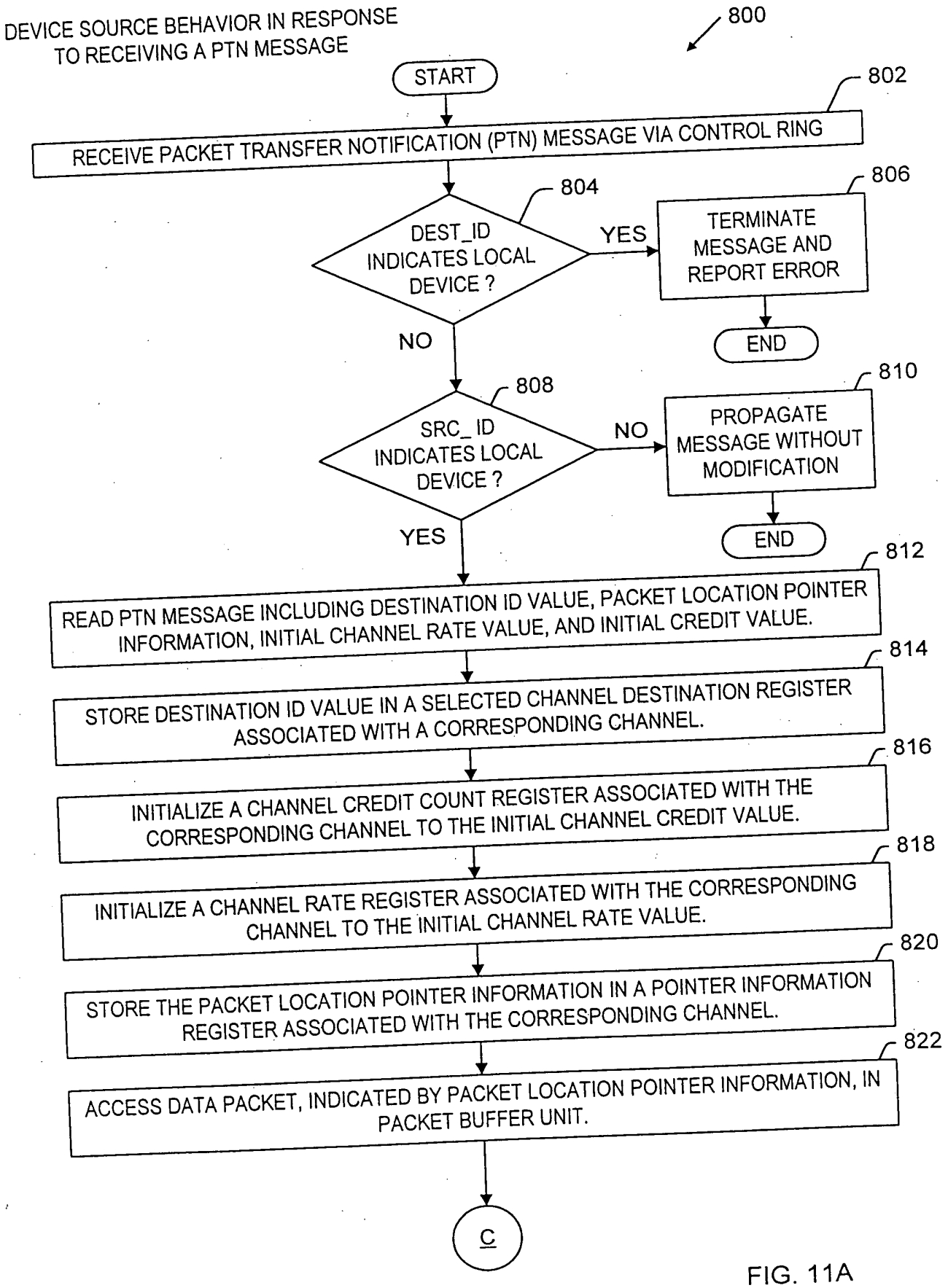

DEVICE SOURCE BEHAVIOR IN RESPONSE TO RECEIVING A PTN MESSAGE
800
START
802
RECEIVE PACKET TRANSFER NOTIFICATION (PTN) MESSAGE VIA CONTROL RING
804
DEST_ID INDICATES LOCAL DEVICE ?
YES
806
TERMINATE MESSAGE AND REPORT ERROR
END
NO
808
SRC_ ID INDICATES LOCAL DEVICE ?
NO
810
PROPAGATE MESSAGE WITHOUT MODIFICATION
END
YES
812
READ PTN MESSAGE INCLUDING DESTINATION ID VALUE, PACKET LOCATION POINTER INFORMATION, INITIAL CHANNEL RATE VALUE, AND INITIAL CREDIT VALUE.
814
STORE DESTINATION ID VALUE IN A SELECTED CHANNEL DESTINATION REGISTER ASSOCIATED WITH A CORRESPONDING CHANNEL.
816
INITIALIZE A CHANNEL CREDIT COUNT REGISTER ASSOCIATED WITH THE CORRESPONDING CHANNEL TO THE INITIAL CHANNEL CREDIT VALUE.
818
INITIALIZE A CHANNEL RATE REGISTER ASSOCIATED WITH THE CORRESPONDING CHANNEL TO THE INITIAL CHANNEL RATE VALUE.
820
STORE THE PACKET LOCATION POINTER INFORMATION IN A POINTER INFORMATION REGISTER ASSOCIATED WITH THE CORRESPONDING CHANNEL.
822
ACCESS DATA PACKET, INDICATED BY PACKET LOCATION POINTER INFORMATION, IN PACKET BUFFER UNIT.
C

FIG. 11A

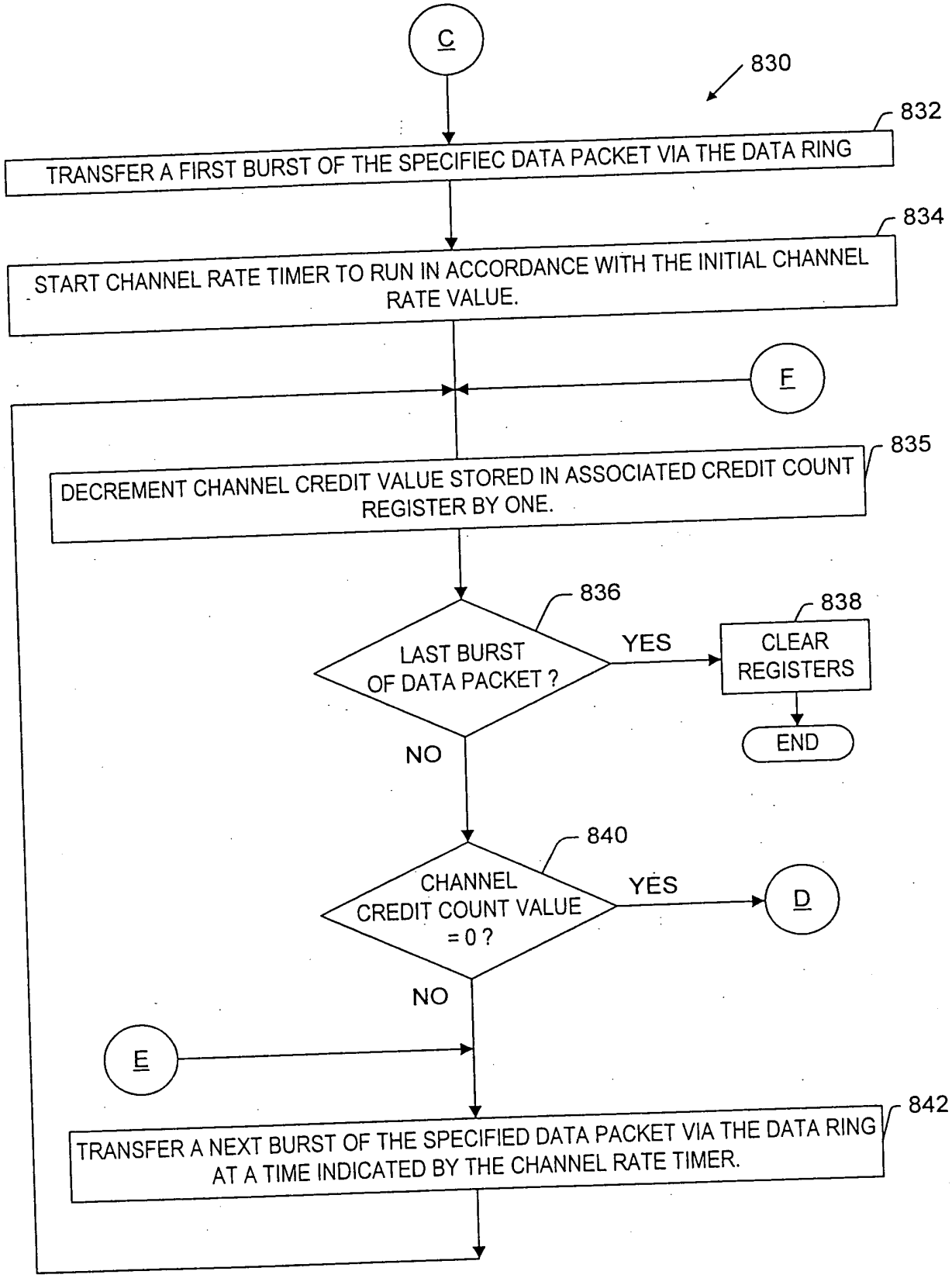

C
830
832
TRANSFER A FIRST BURST OF THE SPECIFIEC DATA PACKET VIA THE DATA RING
834
START CHANNEL RATE TIMER TO RUN IN ACCORDANCE WITH THE INITIAL CHANNEL RATE VALUE.
F
835
DECREMENT CHANNEL CREDIT VALUE STORED IN ASSOCIATED CREDIT COUNT REGISTER BY ONE.
836
LAST BURST OF DATA PACKET ?
YES
838
CLEAR REGISTERS
END
NO
840
CHANNEL CREDIT COUNT VALUE = 0 ?
YES
D
NO
E
842
TRANSFER A NEXT BURST OF THE SPECIFIED DATA PACKET VIA THE DATA RING AT A TIME INDICATED BY THE CHANNEL RATE TIMER.

FIG. 11B

DEVICE SOURCE BEHAVIOR IN RESPONSE TO RECEIVING AN INCREMENTAL CREDIT TRANSFER MESSAGE (ICT MESSAGE)

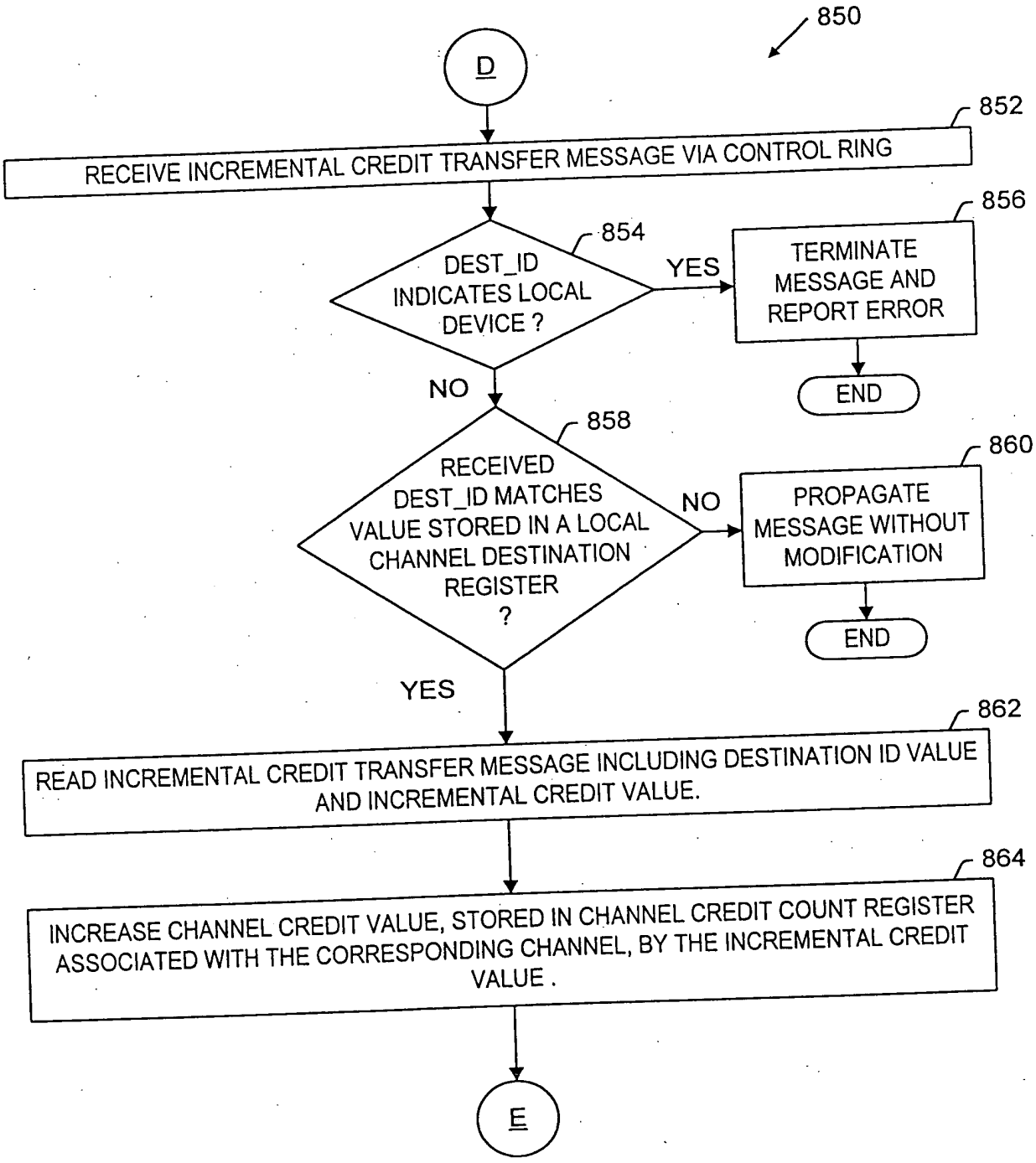


FIG. 12

DEVICE SOURCE BEHAVIOR IN RESPONSE TO RECEIVING AN INCREMENTAL RATE TRANSFER MESSAGE (IRT MESSAGE)

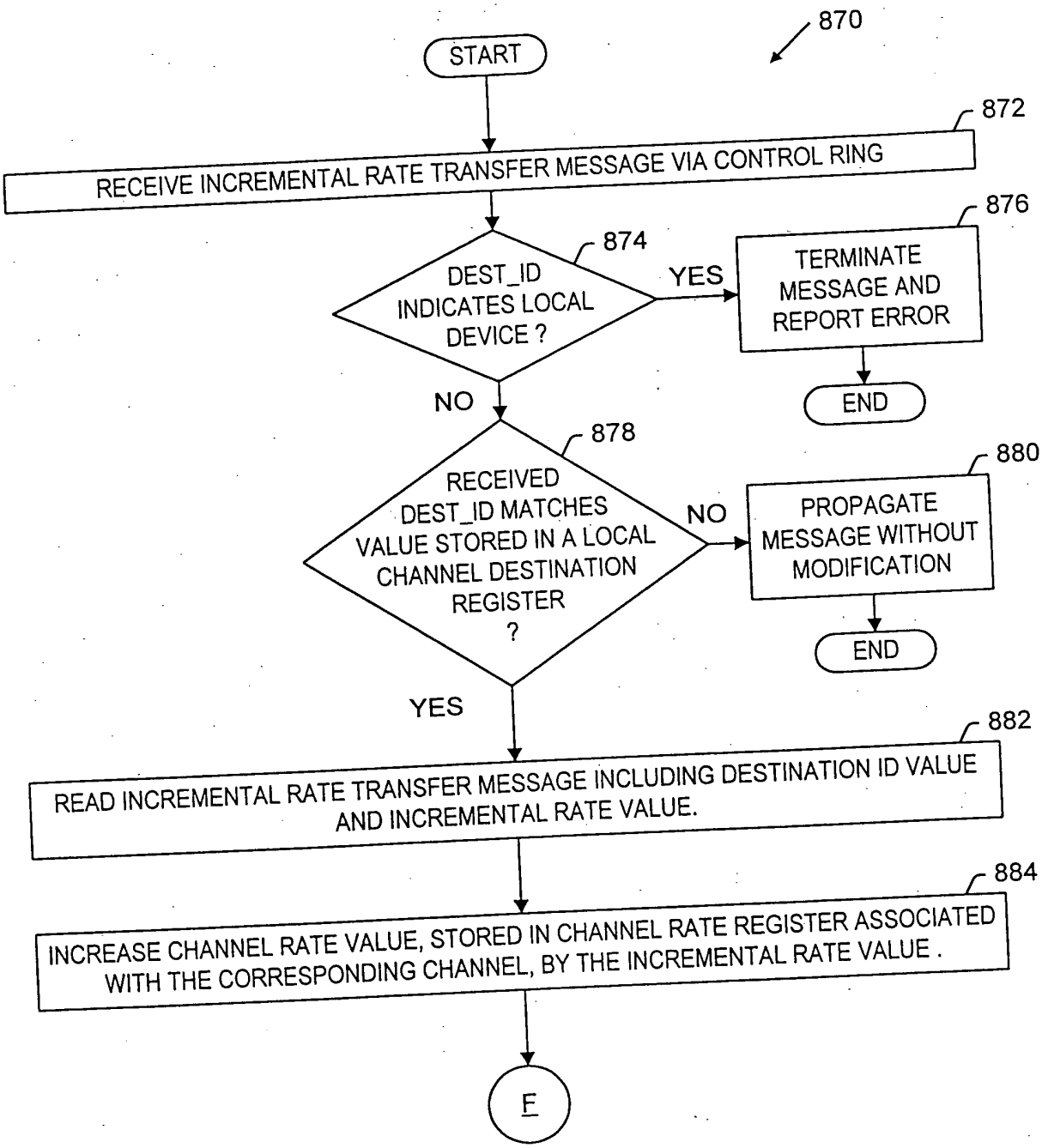


FIG. 13